1890MNRAS..50..547M

Ephemerides of the Satellites of Saturn, 1890–91. By A. Marth.

In the following ephemerides the five inner satellites are assumed to move in circular orbits in the plane of the ring, the ascending node N and inclination J of which, in reference to the plane parallel to the Earth's equator, are assumed to be

for 1891·0, $N = 126^\circ{\cdot}7433$; $J = 6^\circ{\cdot}9802$.

These and the corresponding values, adopted in my previous ephemerides, depend on a modification of Bessel's determination, which I had deduced, some thirty years ago, by taking into account the observed disappearances and reappearances of 1848–49, and by applying corrections to the computed places of *Saturn*, and also a correction pointed out by Beima ("De Annulo Saturni," p. 87). At the time I considered this modification as a merely preliminary one, which would be superseded a few years later, when advantage would have been taken of the favourable opportunities of the years 1861–62 for settling several questions concerning the ball and ring of *Saturn*, and especially whether there is any sensible deviation of the ring from the plane of *Saturn's* equator, in which case the effect would show itself in the observed position-angles of the ring, when it appears as a narrow ellipse. This expectation of thirty years ago having remained unfulfilled, it is high time that, at the end of another revolution of *Saturn*, these questions should be settled or substantial progress towards their settlement made, and it is to be hoped that the superior telescopes and micrometers now available will be devoted to observations of *Saturn* and its satellites during the next two apparitions of the planet.

In the following table P denotes the position-angle of the minor axis of the ring, L + 180° the planetocentric longitude of the Earth referred to the assumed plane of the ring, Λ + 180° that of the Sun or Λ − L the difference between the two. The last column contains the values of $\log \nu = 0{\cdot}950 - \log \Delta$, the *Nautical Almanac* values of the distances Δ of the planet from the Earth being so altered as to take the equation of light into account.

Greenwich Noon.	P	L	Latitude of above plane of Ring		Λ−L	log ν
			Earth	Sun		
1890.	°	°	°	°	°	
Oct. 29	354·600	166·631	−3·339	−5·692	−4·202	9·954275
Nov. 3	·635	167·039	3·140	5·615	4·452	·957224
8	·667	167·420	2·956	5·537	4·676	·960358
13	·697	167·773	2·789	5·460	4·872	·963661
18	·725	168·096	2·638	5·383	5·037	·967117
23	·750	168·387	2·505	5·305	5·170	·970704
28	·772	168·644	2·392	5·228	5·270	9·974402

1890MNRAS..50..547M

Greenwich Noon.		P	L	Latitude of Earth above plane of Ring		A−L	log ν
				Earth	Sun		
1890. Dec.	3	354°·791	168°·865	−2°·298	−5°·150	−5°·334	9·978189
	8	·806	169·048	2·225	5·073	5·360	·982041
	13	·819	169·193	2·173	4·995	5·348	·985933
	18	·828	169·298	2·142	4·918	5·296	·989832
	23	·833	169·363	2·133	4·840	5·204	·993708
	28	·835	169·387	2·146	4·763	5·071	9·997529
1891. Jan.	2	354·833	169·371	−2·180	−4·685	−4·898	0·001264
	7	·828	169·314	2·235	4·608	4·684	·004881
	12	·819	169·217	2·311	4·530	4·431	·008341
	17	·807	169·082	2·408	4·453	4·139	·011610
	22	·791	168·910	2·523	4·375	3·811	·014652
	27	·773	168·704	2·655	4·298	3·449	·017438
Feb.	1	354·752	168·466	−2·802	−4·220	−3·055	0·019936
	6	·729	168·199	2·963	4·143	2·632	·022118
	11	·704	167·907	3·136	4·065	2·184	·023956
	16	·676	167·595	3·318	3·988	1·716	·025427
	21	·648	167·266	3·506	3·910	1·231	·026515
	26	·619	166·924	3·699	3·832	−0·734	·027209
Mar.	3	354·589	166·576	−3·893	−3·755	−0·230	0·027501
	8	·559	166·226	4·086	3·677	+0·276	·027387
	13	·530	165·878	4·275	3·600	0·779	·026866
	18	·501	165·538	4·457	3·522	1·275	·025948
	23	·474	165·209	4·630	3·445	1·759	·024647
	28	·448	164·897	4·793	3·367	2·226	·022980
Apr.	2	354·424	164·607	−4·943	−3·289	+2·672	0·020968
	7	·402	164·341	5·077	3·212	3·093	·018632
	12	·382	164·103	5·195	3·134	3·486	·015999
	17	·365	163·895	5·295	3·057	3·849	·013100
	22	·351	163·720	5·376	2·979	4·179	·009968
	27	·340	163·580	5·438	2·901	4·473	·006634
May	2	354·332	163·477	−5·479	−2·824	+4·731	0·003129
	7	·327	163·411	5·500	2·746	4·952	9·999484
	12	·325	163·384	5·500	2·669	5·134	·995730
	17	·326	163·395	5·479	2·591	5·277	·991902
	22	·330	163·444	5·437	2·514	5·382	·988028
	27	·338	163·532	5·376	2·436	5·449	·984137
June	1	354·348	163·657	−5·295	−2·359	+5·479	9·980254

1890MNRAS..50..547M

Greenwich Noon.		P	L	Latitude of Earth	Sun	A−L	log ν
				above plane of Ring			
1891.		°	°	°	°	°	
June	6	354·362	163·818	−5·194	−2·281	+5·472	9·976404
	11	·378	164·015	5·075	2·204	5·429	·972611
	16	·397	164·246	4·938	2·126	5·352	·968900
	21	·419	164·510	4·785	2·049	5·243	·965290
	26	·443	164·805	4·615	1·971	5·102	·961799
July	1	354·470	165·129	−4·430	−1·894	+4·932	9·958443
	6	·500	165·481	4·231	1·816	4·734	·955236
	11	·532	165·860	4·019	1·739	4·509	·952197
	16	354·566	166·263	−3·795	−1·661	+4·259	9·949338

The values of the apparent equatorial diameter of the ball and of the diameter of the outer rim of the ring depend on Bessel's determinations. The assumed proportion of the polar axis of the ball to the equatorial diameter is 0·900. The "phase" or the defect of illumination of the equatorial diameter is before opposition on the preceding side, and after opposition on the following side.

In the tables for the five satellites *a* and *b* denote the semi-axes of the apparent orbits, *l*—L the orbital longitudes of the satellites reckoned from the points which are in superior conjunction with the planet's centre or in opposition to the Earth in longitude. By adding to *l*—L the value of L from the preceding table, the longitudes *l* are found. These longitudes, which are the orbital longitudes from the ascending node added to the right ascension N of the ascending node, are corrected for the equation of light, and depend on the following assumed values, which contain already the equation corresponding to the distance [0·950]:—

Greenwich Noon.			Mimas. l_1	Euceladus. l_2	Tethys. l_3	Dione. l_4	Rhea. l_5
			°	°	°	°	°
1890	Oct.	19	303·551	116·528	45·280	308·530	179·744
	Nov.	18	243·582	78·485	6·208	294·579	50·447
	Dec.	18	183·616	40·442	327·136	280·627	281·150
1891	Jan.	17	123·652	2·399	288·063	266·676	151·852
	Feb.	16	63·690	324·356	248·991	252·724	22·555
	Mar.	18	3·730	286·313	209·918	238·773	253·257
	Apr.	17	303·773	248·270	170·846	224·821	123·960
	May	17	243·818	210·227	131·773	210·870	354·663
	June	16	183·864	172·184	92·700	196·918	225·365
	July	16	123·913	134·141	53·627	182·967	96·068

The values of P, *a*, *b*, and *l*—L are to be interpolated directly for the times for which the apparent positions of the satellites are

1890MNRAS..50..547M

required, and the rectangular coordinates x and y reckoned parallel to the major and minor axis of the ring, or, if polar coordinates are wanted, the position-angles p and distances s of the satellites in reference to the planet's centre are then found by means of the formulæ

$$s \sin (p-\mathrm{P}) = x = a \sin (l-\mathrm{L})$$
$$s \cos (p-\mathrm{P}) = y = b \cos (l-\mathrm{L}).$$

Greenwich Noon.	Diameter of Ball. Equat.	Phase.	Polar.	Axis of Ring Major	Minor	*Mimas.* a_1	b_1	$l_1-\mathrm{L}$	Diff.
1890.	″	″	″	″	″	″	″	°	°
Oct. 29	16·43	0·022	14·80	37·88	2·21	25·88	−1·51	354·75	1909·74
Nov. 3	16·54	·025	14·90	38·14	2·09	26·06	−1·43	104·49	·78
8	16·67	·028	15·00	38·42	1·98	26·25	1·35	214·27	·82
13	16·79	·030	15·12	38·71	1·88	26·45	1·29	324·09	·85
18	16·93	·033	15·24	39·02	1·80	26·66	1·23	73·94	·89
23	17·07	·035	15·36	39·34	1·72	26·88	1·18	183·83	·93
28	17·21	·036	15·49	39·68	1·66	27·11	1·13	293·76	1909·97
Dec. 3	17·36	·037	15·63	40·03	1·61	27·35	−1·10	33·73	1910·00
8	17·52	·038	15·77	40·38	1·57	27·59	1·07	153·73	·04
13	17·68	·038	15·91	40·75	1·54	27·84	1·06	263·77	·08
18	17·84	·038	16·05	41·11	1·54	28·09	1·05	13·85	·12
23	18·00	·037	16·20	41·48	1·54	28·34	1·05	123·97	·16
28	18·15	·035	16·34	41·85	1·57	28·59	1·07	234·13	·19
1891.									
Jan. 2	18·31	0·033	16·48	42·21	1·61	28·84	−1·10	344·32	1910·22
7	18·46	·031	16·62	42·56	1·66	29·08	1·13	94·54	·26
12	18·61	·028	16·75	42·90	1·73	29·31	1·18	204·80	·28
17	18·75	·024	16·88	43·23	1·82	29·53	1·24	315·08	·31
22	18·88	·021	17·00	43·53	1·92	29·74	1·31	65·39	·34
27	19·01	·017	17·11	43·81	2·03	29·93	1·39	175·73	·35
Feb. 1	19·12	·014	17·21	44·07	2·15	30·11	−1·47	286·08	1910·37
6	19·21	·010	17·30	44·29	2·29	30·26	1·56	36·45	·38
11	19·29	·007	17·37	44·48	2·43	30·39	1·66	146·83	·38
16	19·36	·004	17·43	44·63	2·58	30·49	1·76	257·21	·38
21	19·41	·002	17·47	44·74	2·74	30·57	1·87	7·59	·38
26	19·44	·001	17·50	44·81	2·89	30·62	1·97	117·97	·37
Mar. 3	19·45	...	17·52	44·84	3·04	30·64	−2·08	228·34	1910·35
8	19·45	...	17·51	44·83	3·19	30·63	2·18	338·69	·33
13	19·42	·001	17·49	44·77	3·34	30·59	2·28	89·02	·31
18	19·38	·002	17·46	44·68	3·47	30·53	2·37	199·33	·28
23	19·32	·005	17·40	44·55	3·60	30·44	2·46	309·61	·24
28	19·25	·007	17·34	44·38	3·71	30·32	2·53	59·85	·21

1890MNRAS..50..547M

Greenwich Noon.	Diameter of Ball.			Axis of Ring		*Mimas.*			
	Equat.	Phase.	Polar.	Major	Minor	a_1	b_1	l_1-L	Diff.
1891.	″	″	″	″	″	″	″	°	°
Apr. 2	19·16	0·011	17·26	44·17	3·81	30·18	−2·60	170·06	1910·18
7	19·06	·014	17·17	43·93	3·89	30·02	2·66	280·24	·13
12	18·94	·018	17·07	43·67	3·95	29·84	2·70	30·37	·09
17	18·82	·021	16·95	43·38	4·00	29·64	2·74	140·46	·04
22	18·68	·025	16·83	43·07	4·04	29·42	2·76	250·50	1910·00
27	18·54	·028	16·70	42·74	4·05	29·20	2·77	0·50	1909·95
May 2	18·39	·031	16·57	42·39	4·05	28·96	−2·77	110·45	·91
7	18·24	·034	16·43	42·04	4·03	28·72	2·75	220·36	·87
12	18·08	·036	16·29	41·68	3·99	28·47	2·73	330·23	·82
17	17·92	·038	16·15	41·31	3·94	28·22	2·69	80·05	·78
22	17·76	·039	16·00	40·94	3·88	27·97	2·65	189·83	·74
27	17·60	·040	15·86	40·58	3·80	27·72	2·60	299·59	·70
June 1	17·45	·040	15·72	40·22	3·71	27·48	−2·54	49·27	1909·66
6	17·29	·039	15·58	39·86	3·61	27·24	2·47	158·93	·63
11	17·14	·038	15·44	39·52	3·50	27·00	2·39	268·56	·60
16	17·00	·037	15·31	39·18	3·37	26·77	2·30	18·16	·57
21	16·86	·035	15·18	38·86	3·24	26·55	2·21	127·73	·54
26	16·72	·033	15·06	38·54	3·10	26·33	2·12	237·27	·51
July 1	16·59	·031	14·94	38·25	2·95	26·13	−2·02	346·78	·50
6	16·47	·028	14·83	37·97	2·80	25·94	1·91	96·28	·48
11	16·36	·025	14·73	37·70	2·64	25·76	1·81	205·76	1909·46
16	16·25	0·022	14·63	37·45	2·48	25·59	−1·69	315·22	

reenwich Noon.	*Enceladus.*				*Tethys.*			
	a_2	b_2	l_2-L	Diff.	a_3	b_3	l_3-L	Diff.
1890.	″	″	°	°	″	″	°	°
ct. 29	33·20	−1·93	55·71	1313·36	41·10	−2·39	344·53	953·16
ov. 3	33·43	−1·83	289·07	·38	41·38	−2·27	217·69	·18
8	33·67	1·74	162·45	·42	41·68	2·15	90·87	·22
13	33·93	1·65	35·87	·45	42·00	2·04	324·09	·25
18	34·20	1·57	269·32	·49	42·34	1·95	197·34	·28
23	34·48	1·51	142·81	·53	42·69	1·87	70·62	·32
28	34·78	1·45	16·34	·56	43·05	1·80	303·94	·36
ec. 3	35·09	−1·41	249·90	1313·60	43·43	−1·74	177·30	953·39
8	35·40	1·37	123·50	·64	43·82	1·70	50·69	·43
13	35·72	1·35	357·14	·68	44·21	1·68	284·13	·47
18	36·04	1·35	230·82	·72	44·61	1·67	157·60	·51
23	36·36	1·35	104·54	·75	45·01	1·68	31·11	·55
28	36·68	1·37	338·29	·79	45·41	1·70	264·66	

1890MNRAS..50..547M

Greenwich Noon.	*Enceladus.* a_2	b_2	l_2-L	Diff.	*Tethys.* a_3	b_3	l_3-L	Diff.
1891.	″	″	°	°	″	″	°	°
Jan. 2	37·00	−1·41	212·08	1313·83	45·80	−1·74	138·25	953·6
7	37·31	1·46	85·91	·87	46·18	1·80	11·88	·6
12	37·61	1·52	319·78	·89	46·55	1·88	245·54	·7
17	37·89	1·59	193·67	·92	46·90	1·97	119·24	·7
22	38·16	1·68	67·59	·95	47·23	2·08	352·96	·7
27	38·40	1·78	301·54	·97	47·54	2·20	226·72	·7
Feb. 1	38·62	−1·89	175·51	1313·99	47·81	−2·34	100·50	953·8
6	38·82	2·01	49·50	1314·01	48·05	2·48	334·30	·8
11	38·98	2·13	283·51	·02	48·25	2·64	208·12	·8
16	39·11	2·26	157·53	·02	48·42	2·80	81·95	·8
21	39·21	2·40	31·55	·02	48·54	2·97	315·79	·8
26	39·28	2·53	265·57	·01	48·62	3·14	189·63	·8
Mar. 3	39·30	−2·67	139·58	1314·01	48·65	−3·30	63·47	953·
8	39·29	2·80	13·59	1313·99	48·64	3·47	297·31	·
13	39·24	2·93	247·58	·97	48·58	3·62	171·13	·
18	39·16	3·04	121·55	·95	48·48	3·77	44·94	·
23	39·04	3·15	355·50	·93	48·33	3·90	278·73	·
28	38·89	3·25	229·43	·89	48·15	4·02	152·50	·
Apr. 2	38·71	−3·34	103·32	1313·85	47·93	−4·13	26·23	953·
7	38·51	3·41	337·17	·82	47·67	4·22	259·94	·
12	38·28	3·47	210·99	·78	47·38	4·29	133·61	·
17	38·02	3·51	84·77	·74	47·07	4·34	7·24	·
22	37·75	3·54	318·51	·70	46·73	4·38	240·83	·
27	37·46	3·55	192·21	·66	46·37	4·39	114·39	·
May 2	37·16	−3·55	65·87	1313·61	46·00	−4·39	347·90	953·
7	36·85	3·53	299·48	·57	45·61	4·37	221·37	·
12	36·53	3·50	173·05	·52	45·22	4·33	94·80	·
17	36·21	3·46	46·57	·49	44·82	4·28	328·19	·
22	35·89	3·40	280·06	·45	44·42	4·21	201·54	·
27	35·57	3·33	153·51	·41	44·03	4·12	74·85	·
June 1	35·25	−3·25	26·92	1313·37	43·64	−4·03	308·12	953
6	34·94	3·16	260·29	·34	43·25	3·92	181·36	
11	34·64	3·06	133·63	·30	42·87	3·79	54·56	
16	34·34	2·96	6·93	·27	42·51	3·66	287·72	
21	34·06	2·84	240·20	·25	42·16	3·52	160·86	
26	33·78	2·72	113·45	·22	41·82	3·37	33·97	
July 1	33·52	−2·59	346·67	·20	41·50	−3·21	267·05	
6	33·28	2·46	219·87	·18	41·19	3·04	140·10	
11	33·05	2·32	93·05	1313·15	40·91	2·87	13·14	953
16	32·82	−2·17	326·20		40·64	−2·69	246·15	

1890MNRAS..50..547

ch	*Dione.*				*Rhea.*			
	a_4	b_4	$l_4-\mathrm{L}$	Diff.	a_5	b_5	$l_5-\mathrm{L}$	Diff.
	″	″	°	°	″	″	°	°
	52·64	−3·07	16·49	657·32	73·52	−4·28	89·56	398·07
	53·00	−2·90	313·81	·35	74·02	−4·05	127·63	·10
	53·38	2·75	251·16	·38	74·55	3·84	165·73	·13
	53·79	2·62	188·54	·41	75·12	3·65	203·86	·16
	54·22	2·50	125·95	·44	75·72	3·49	242·02	·20
	54·67	2·39	63·39	·48	76·35	3·34	280·22	·23
	55·14	2·30	0·87	·52	77·00	3·21	318·45	·27
	55·62	−2·23	298·39	657·55	77·68	−3·11	356·72	398·30
	56·12	2·18	235·94	·59	78·37	3·04	35·02	·35
	56·62	2·15	173·53	·64	79·07	3·00	73·37	·38
	57·13	2·14	111·17	·67	79·79	2·98	111·75	·42
	57·64	2·15	48·84	·71	80·50	3·00	150·17	·47
	58·15	2·18	346·55	·75	81·21	3·04	188·64	·50
	58·66	−2·23	284·30	657·78	81·91	−3·12	227·14	398·54
	59·15	2·31	222·08	·83	82·60	3·22	265·68	·58
	59·62	2·40	159·91	·86	83·26	3·36	304·26	·62
	60·07	2·52	97·77	·89	83·89	3·52	342·88	·65
	60·49	2·66	35·66	·92	84·48	3·72	21·53	·68
	60·88	2·82	333·58	·95	85·02	3·94	60·21	·71
	61·23	−2·99	271·53	·98	85·51	−4·18	98·92	398·73
	61·54	3·18	209·51	657·99	85·94	4·44	137·65	·76
	61·80	3·38	147·50	658·01	86·31	4·72	176·41	·78
	62·01	3·59	85·51	·02	86·60	5·01	215·19	·79
	62·17	3·80	23·53	·03	86·82	5·30	253·98	·80
	62·27	4·02	321·56	·03	86·96	5·61	292·78	·80
	62·31	−4·23	259·59	·02	87·02	−5·91	331·58	398·80
	62·29	4·44	197·61	·01	86·99	6·20	10·38	·79
	62·22	4·64	135·62	658·00	86·89	6·48	49·17	·78
	62·09	4·83	73·62	657·99	86·71	6·74	87·95	·77
	61·90	5·00	11·61	·96	86·45	6·98	126·72	·75
	61·67	5·15	309·57	·93	86·12	7·20	165·47	·72
	61·38	−5·29	247·50	·91	85·72	−7·39	204·19	398·70
	61·05	5·40	185·41	·87	85·26	7·55	242·89	·66
	60·68	5·49	123·28	·84	84·74	7·67	281·55	·63
	60·28	5·56	61·12	·80	84·18	7·77	320·18	·60
	59·85	5·61	358·92	·77	83·57	7·83	358·78	·56
	59·39	5·63	296·69	·73	82·93	7·86	37·34	·52
	58·91	−5·63	234·42	657·68	82·27	−7·86	75·86	398·48

1890MNRAS..50..547M

Greenwich Noon.	*Dione.* a_4	b_4	l_4-L	Diff.	*Rhea.* a_5	b_5	l_5-L	Diff.
1891.	″	″	°	°	″	″	°	°
May 7	58·42	−5·60	172·10	657·64	81·58	−7·82	114·34	398·44
12	57·92	5·55	109·74	·60	80·88	7·75	152·78	·41
17	57·41	5·48	47·34	·56	80·17	7·65	191·19	·36
22	56·90	5·39	344·90	·53	79·46	7·53	229·55	·3
27	56·39	5·28	282·43	·49	78·75	7·38	267·87	·2
June 1	55·89	−5·16	219·92	657·45	78·05	−7·20	306·16	398·2
6	55·39	5·01	157·37	·42	77·36	7·00	344·41	·2
11	54·91	4·86	94·79	·38	76·68	6·78	22·63	·1
16	54·44	4·69	32·17	·35	76·03	6·55	60·81	·1
21	53·99	4·50	329·52	·32	75·40	6·29	98·96	·1
26	53·56	4·31	266·84	·29	74·80	6·02	137·08	·0
July 1	53·15	−4·11	204·13	·27	74·22	−5·73	175·17	·0
6	52·76	3·89	141·40	·25	73·68	5·44	213·24	·0
11	52·39	3·67	78·65	657·22	73·16	5·13	251·28	398·0
16	52·05	−3·44	15·87		72·68	−4·81	289·29	

Differences of right ascension and declination between Titan and Iapetus and the centre of Saturn.

Greenwich Noon.	*Titan.* α_6-A	δ_6-D	*Iapetus.* α_8-A	δ_8-D
1890.	s	″	s	″
Oct. 29	+10·49	+10·0	− 0·54	−43·1
30	+11·07	+14·7	3·20	39·3
31	+ 9·84	+17·0	5·84	35·1
Nov. 1	+ 6·97	+16·3	8·45	30·7
2	+ 2·95	+13·0	11·01	26·0
3	− 1·57	+ 7·5	−13·51	−21·1
4	− 5·85	+ 0·9	15·92	16·0
5	− 9·27	− 5·9	18·24	10·8
6	−11·34	−11·7	20·44	− 5·4
7	−11·82	−15·8	22·52	+ 0·1
8	−10·62	−17·6	−24·45	5·6
9	− 7·94	−16·9	26·23	11·1
10	− 4·12	−13·7	27·85	16·6
11	+ 0·30	− 8·6	29·29	22·1
12	+ 4·69	− 2·2	30·55	27·5
13	+ 8·37	+ 4·6	−31·62	+32·7
14	+10·72	+10·5	32·49	37·8
15	+11·33	+14·7	33·16	42·7
16	+10·06	+16·4	33·62	47·4
17	+ 7·12	+15·3	33·88	51·8

1890MNRAS..50..547M

Greenwich Noon. 1890.	*Titan.* $\alpha_6 - A$	*Titan.* $\delta_6 - D$	*Iapetus.* $\alpha_8 - A$	*Iapetus.* $\delta_8 - D$
	s	″	s	″
Nov. 18	+ 3·00	+11·7	−33·92	+56·0
19	− 1·63	+ 6·1	33·75	59·8
20	− 6·01	− 0·4	33·38	63·3
21	− 9·51	− 6·8	32·81	66·4
22	−11·64	−12·2	32·03	69·2
23	−12·11	−15·8	−31·06	+71·5
24	−10·88	−17·2	29·90	73·4
25	− 8·11	−16·1	28·56	74·9
26	− 4·18	−12·7	27·04	76·0
27	+ 0·37	− 7·4	25·36	76·6
28	+ 4·87	− 1·0	−23·52	+76·8
29	+ 8·63	+ 5·5	21·54	76·5
30	+11·09	+11·1	19·43	75·8
Dec. 1	+11·62	+14·9	17·20	74·6
2	+10·29	+16·1	14·86	73·0
3	+ 7·24	+14·7	−12·42	+70·9
4	+ 2·99	+10·8	9·91	68·4
5	− 1·77	+ 5·2	7·33	65·5
6	− 6·26	− 1·3	4·70	62·2
7	− 9·84	− 7·6	−2·03	58·5
8	−11·99	−12·7	+0·66	+54·5
9	−12·44	−16·0	3·35	50·1
10	−11·13	−17·1	6·04	45·3
11	− 8·25	−15·7	8·71	40·3
12	− 4·18	−12·1	11·33	35·1
13	+ 0·51	− 6·7	+13·90	+29·6
14	+ 5·13	− 0·3	16·41	23·9
15	+ 9·06	+ 6·2	18·83	18·0
16	+11·39	+11·7	21·14	12·0
17	+11·91	+15·2	23·35	+ 5·9
18	+10·50	+16·2	+25·43	− 0·3
19	+ 7·31	+14·5	27·37	6·5
20	+ 2·89	+10·5	29·15	12·7
21	− 2·00	+ 4·6	30·77	18·9
22	− 6·61	− 1·9	32·22	25·0
23	−10·24	− 8·1	+33·48	−30·9
24	−12·39	−13·3	34·54	36·7
25	−12·78	−16·5	35·40	42·3
26	−11·35	−17·4	36·05	47·6

1890MNRAS..50..547M

Approximate Greenwich times of conjunctions of the satellites with the ends of the ring (*f* conj. with the *f*ollowing, *p* with the *p*receding end), "n," north, "s," south of the major axis of the ring. For Te., Di., Rh., the times of greatest elongations (e. east, w. west) are also given.

1890.	h	
Nov. 10	15·1	Rh. fs.
	16·2	En. fn.
	19·9	Te. w.
	20·6	Mi. pn.
	21·2	Di. w.
	22·6	En. pn.
	23·1	Tit. sup. ☌ with centre, s. 9″
11	13·7	Rh. e.
	15·0	En. fs.
	17·5	Di. fs.
	18·5	Te. e.
	19·3	Mi. pn.
12	17·2	Te. w.
	17·5	En. ps.
	17·9	Mi. pn.
	18·5	Di. fn.
	21·3	Rh. pn.
13	14·9	Di. w.
	15·8	Te. e.
	16·3	En. pn.
	16·5	Mi. pn.
	19·9	Rh. w.
	21·9	Mi. ps.
	23·7	Te. fn.
14	14·5	Te. w.
	15·1	Mi. pn.
	18·6	Rh. ps.
	18·9	En. fn.
	20·5	Mi. ps.
	22·3	Te. ps.
	23·7	Di. e.
15	17·7	En. fs.
	19·2	Mi. ps.
	20·0	Di. pn.
	21·0	Te. fn.
16	17·8	Mi. ps.
	19·7	Te. ps.
	20·2	En. ps.
	21·1	Di. ps.
	23·7	Mi. fs.
17	0·7	Rh. fn.
	16·4	Mi. ps.
	17·4	Di. e.
	18·3	Te. fn.
	19·0	En. pn.
	22·3	Mi. fs.
18	1·3	Te. pn.
	13·8	Di. pn.
	15·0	Mi. ps.
	15·8	Tit. inf. ☌ with centre, n. 8″
Nov. 18	17·0	Te. ps.
	20·9	Mi. fs.
	21·5	En. fn.
19	0·0	Te. fs.
	14·8	Di. ps.
	15·6	Te. fn.
	16·0	Rh. fs.
	19·5	Mi. fs.
	20·4	En. fs.
	22·6	Di. fs.
	22·6	Te. pn.
20	14·3	Te. ps.
	14·7	Rh. e.
	18·2	Mi. fs.
	21·3	Te. fs.
	22·9	En. ps.
	23·6	Mi. fn.
	23·7	Di. fn.
21	13·3	Rh. fn.
	15·3	En. fn.
	16·8	Mi. fs.
	19·9	Te. pn.
	20·0	Di. w.
	21·7	En. pn.
	22·2	Mi. fn.
	22·3	Rh. pn.
22	16·3	Di. fs.
	18·6	Te. fs.
	20·8	Mi. fn.
	20·9	Rh. w.
23	0·2	En. fn.
	2·4	Te. e.
	16·6	En. ps.
	17·3	Te. pn.
	17·4	Di. fn.
	19·4	Mi. fn.
	19·5	Rh. ps.
	23·0	En. fs.
24	13·7	Di. w.
	15·5	En. pn.
	15·9	Te. fs.
	18·0	Mi. fn.
	23·8	Te. e.
25	14·6	Te. pn.
	16·7	Mi. fn.
	18·0	En. fn.
	22·4	Te. w.
	22 6	Di. e.
26	16·8	En. fn.
	18·9	Di. pn.
	21·1	Te. e.
	21·2	Mi. pn.
Nov. 26	22·3	Tit. sup. ☌ s. 8″
27	19·3	En. ps.
	19·7	Te. w.
	19·8	Mi. pn.
	19·9	Di. ps.
28	16·3	Di. e.
	17·0	Rh. fs.
	18·1	En. pn.
	18·4	Te. e.
	23·8	Mi. ps.
29	2·2	Te. fn.
	15·6	Rh. e.
	17·0	Te. w.
	17·0	Mi. pn.
	20·6	En. fn.
	22·4	Mi. ps.
30	0·9	Te. ps.
	1·1	Di. w.
	13·6	Di. ps.
	14·2	Rh. fn.
	15·6	Mi. pn.
	15·7	Te. e.
	19·5	En. fs.
	21·0	Mi. ps.
	21·4	Di. fs.
	23·2	Rh. pn.
	23·5	Te. fn.
Dec. 1	14·4	Te. w.
	19·7	Mi. ps.
	21·9	Rh. w.
	22·0	En ps.
	22·2	Te. ps.
	22·5	Di. fn.
2	13·0	Te. e.
	14·4	En. fn.
	18·3	Mi. ps.
	18·8	Di. w.
	20·5	Rh. ps.
	20·8	En. pn.
	20·8	Te. fn.
3	11·7	Te. w.
	13·2	En. fs.
	15·1	Di. fs.
	16·9	Mi. ps.
	19·5	Te. ps.
4	15·3	Tit. inf. ☌ n. 7″. Transit.
	15·5	Mi. ps.
	15·8	En. ps.
	16·2	Di. fn.
	18·1	Te. fn.

1890MNRAS..50..547M

1890.	h	
Dec. 4	21·4	Mi. fs.
	22·1	En. fs.
5	0·0	Di. fn.
	12·5	Di. w.
	14·1	Mi. ps.
	14·6	En. pn.
	16·8	Te. ps.
	20·0	Mi. fs.
	23·8	Te. fs.
6	15·4	Te. fn.
	17·1	En. fn.
	18·7	Mi. fs.
	21·4	Di. e.
	22·4	Te. pn.
7	14·1	Te. ps.
	15·9	En. fs.
	17·3	Mi. fs.
	17·7	Di. pn.
	17·9	Rh. fs.
	21·1	Te. fs.
	22·7	Mi. fn.
8	12·8	Te. fn.
	15·9	Mi. fs.
	16·6	Rh. e.
	18·4	En. ps.
	18·7	Di. ps.
	19·7	Te. pn.
	21·3	Mi. fn.
9	15·1	Di. e.
	15·2	Rh. fn.
	17·2	En. pn.
	18·4	Te. fs.
	19 9	Mi. fn.
10	0·2	Rh. pn.
	17·1	Te. pn.
	18·5	Mi. fn.
	19·7	En. fn.
	22·8	Rh. w.
	23·9	Di. w.
11	15·7	Te. fs.
	17·2	Mi. fn.
	18·5	En. fs.
	20·1	Di. fs.
	21·4	Rh. ps.
	23·1	Mi. pn.
	23·6	Te. e.
12	14·4	Te. pn.
	15·8	Mi. fn.
	21·1	En. ps.
	21·3	Di. fn.
	21·6	Tit. sup. ☌ s. 7″. Occult.
Dec. 12	21·7	Mi. pn.
	22·2	Te. w.
13	13·0	Te. fs.
	13·5	En. fn.
	14·4	Mi. fn.
	17·6	Di. w.
	19·9	En. pn.
	20·3	Mi. pn.
	20·9	Te. e.
14	12·6	Rh. pn.
	13·0	Mi. fn.
	13·9	Di. fs.
	18·9	Mi. pn.
	19·5	Te. w.
	22·4	En. fn.
15	14·8	En. ps.
	15·0	Di. fn.
	17·5	Mi. pn.
	18·2	Te. e.
	21·2	En. fs.
	22·8	Di. pn.
	22·9	Mi. ps.
16	11·3	Di. w.
	13·6	En. pn.
	16·2	Mi. pn.
	16·8	Te. w.
	18 8	Rh. fs.
	21·5	Mi. ps.
	23·7	En. ps.
	23·8	Di. ps.
17	0·6	Te. ps.
	15·5	Te. e.
	16·2	En. fn.
	17·4	Rh. e.
	20·1	Di. e.
	20·2	Mi. ps.
	22·5	En. pn.
	23·3	Te. fn.
18	14·1	Te. w.
	15·0	En. fs.
	16·0	Rh. fn.
	16·4	Di. pn.
	18·8	Mi. ps.
	22·0	Te. ps.
19	12·8	Te. e.
	17·4	Mi. ps.
	17·5	Di. ps.
	17·5	En. ps.
	20·6	Te. fn.
	23·3	Mi. fs.
	23·7	Rh. w.
	23·8	En. fs.
Dec. 20	11·4	Te. w.
	13·8	Di. e.
	14·4	Tit. inf. ☌ n. 7″. Transit
	16·0	Mi. ps.
	16·3	En. pn.
	19·3	Te. ps.
	21·9	Mi. fs.
	22·2	Rh. ps.
21	14·6	Mi. ps.
	17·9	Te. fn.
	18·8	En. fn.
	20·5	Mi. fs.
	22·7	Di. w.
22	0·9	Te. pn.
	11·2	Di. ps.
	11·3	En. ps.
	13·3	Mi. ps.
	16·6	Te. ps.
	17·6	En. fs.
	19·0	Di. fs.
	19·2	Di. fs.
	23·6	Te. fs.
23	13·5	Rh. pn.
	15·2	Te. fn.
	17·8	Mi. fs.
	20 0	Di. fn.
	20·1	En. ps.
	22·2	Te. pn.
24	12·1	Rh. w.
	12·6	En. fn.
	13·9	Te. ps.
	16·3	Di. w.
	16·4	Mi. fs.
	18·9	En. pn.
	20·9	Te. fs.
	21·8	Mi. fn.
25	12·5	Te. fn.
	12·6	Di. fs.
	15·0	Mi. fs.
	19·5	Te. pn.
	19·7	Rh. fs.
	20·4	Mi. fn.
	21·5	En. ps.
26	13·7	Di. fn.
	13·9	En. fn.
	18·2	Te. fs.
	18·3	Rh. e.
	19·0	Mi. fn.
	20·3	En. pn.
	21·5	Di. pn.

The rest of the ephemerides will be published in the next number of the *Monthly Notices*.

1890MNRAS..50..547M

Ephemeris of the Satellite of Neptune, 1890–91.
By A. Marth.

Greenwich Noon.	P′	a	b	u−U	Diff.	U	B
1890.	°	″	″	°	°	°	°
Oct. 29	328·00	16·88	9·19	239·05	612·32	124·82	−32·96
Nov. 8	327·76	16·92	9·18	131·37	·29	125·10	32·87
18	327·50	16·95	9·17	23·66	·26	125·40	32·77
28	327·23	16·96	9·15	275·92	·27	125·72	32·66
Dec. 8	326·97	16·95	9·12	168·19	·27	126·01	32·55
18	326·72	16·92	9·07	60·46	·28	126·30	32·44
28	326·49	16·87	9·02	312·74	·31	126·57	32·34
1891.							
Jan. 7	326·30	16·81	8·97	205·05	612·35	126·79	−32·25
17	326·14	16·74	8·91	97·40	·40	126·97	32·18
27	326·04	16·65	8·85	349·80	·45	127·10	32·12
Feb. 6	325·98	16·56	8·80	242·25	·51	127·17	32·08
16	325·97	16·47	8·75	134·76	·57	127·18	32·07
26	326·01	16·37	8·70	27·33	·63	127·12	32·08
Mar. 8	326·11	16·28	8·65	279·96	·69	127·00	32·11
18	326·26	16·19	8·62	172·65	·75	126·82	32·17
28	326·45	16·11	8·59	65·40	612·81	126·59	32·24
Apr. 7	326·69	16·04	8·58	318·21		126·31	−32·33

Assumed value of N = 185°·20; of J = 119°·10.

The values of $u-\mathrm{U}$, P′, a and b are to be interpolated directly for the times for which the apparent positions of the satellite are required, and the position-angles p and distances s of the satellite are then found by means of the formulæ

$$s \sin (\mathrm{P}'-p) = a \sin (u-\mathrm{U}),$$
$$s \cos (\mathrm{P}'-p) = b \cos (u-\mathrm{U}).$$

The satellite moves in the direction of decreasing position-angles, and will be at its greatest elongations (*nf* in pos. P′ + 90°, *sp* in pos. P′ − 90° at distance a) and at its conjunctions (superior in pos. P′, inferior in pos. P′ − 180° at distance b) about the following Greenwich times:—